

TDK Antenna Measurement

TDK Corporation

Electronic Components Business Company

Communication Devices Business Group

Jul. 8th, 2026

CONFIDENTIAL

Measurement Basic Information

▶ Measurement Basic Information

- Test Date : 2026/7/7
- Name of Test Personnel : Shohei Sakai

- Name of Commercial Test Software in Use :

Software for controlling StarLab used during radiation characteristic measurement: WaveStudio

Software for outputting raw data of radiation characteristics: SatEnv

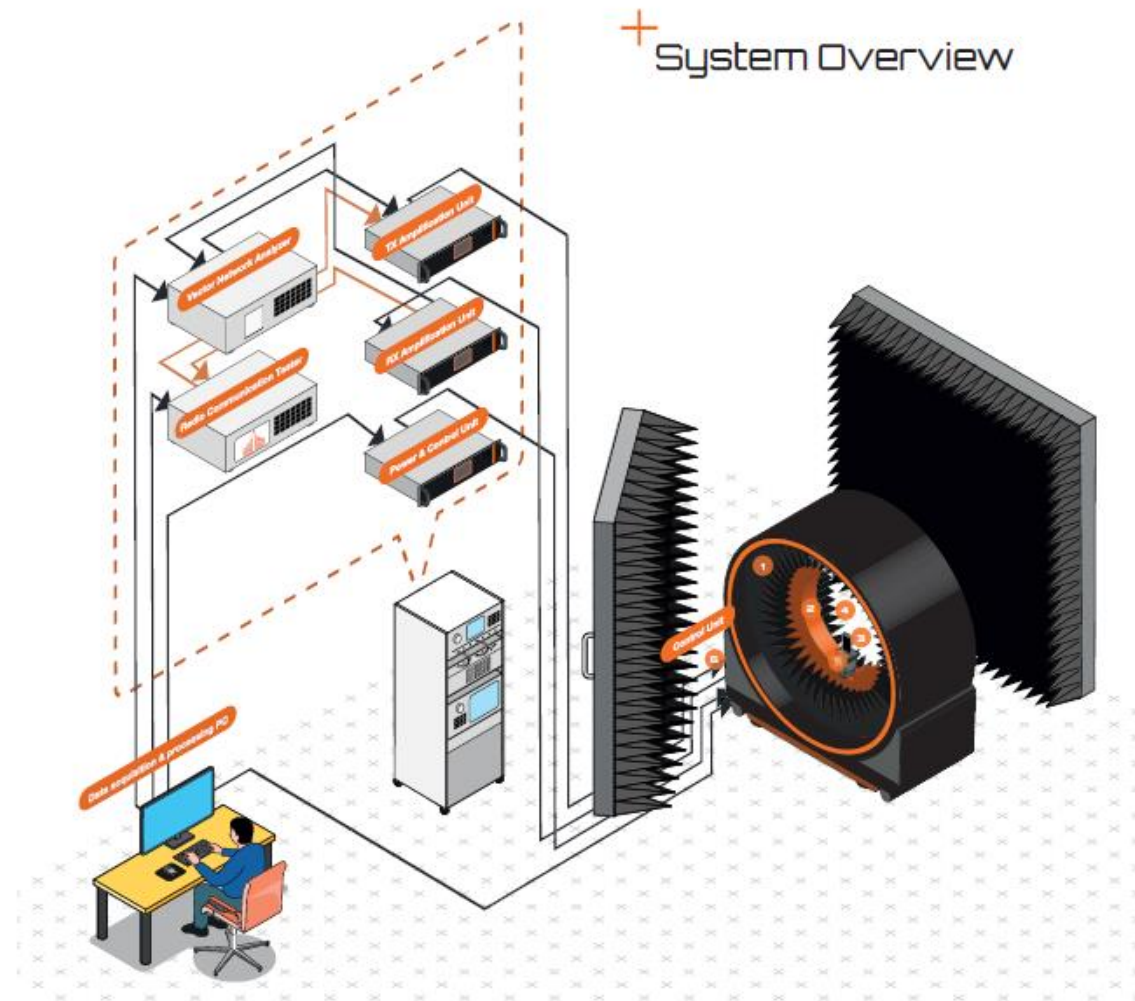
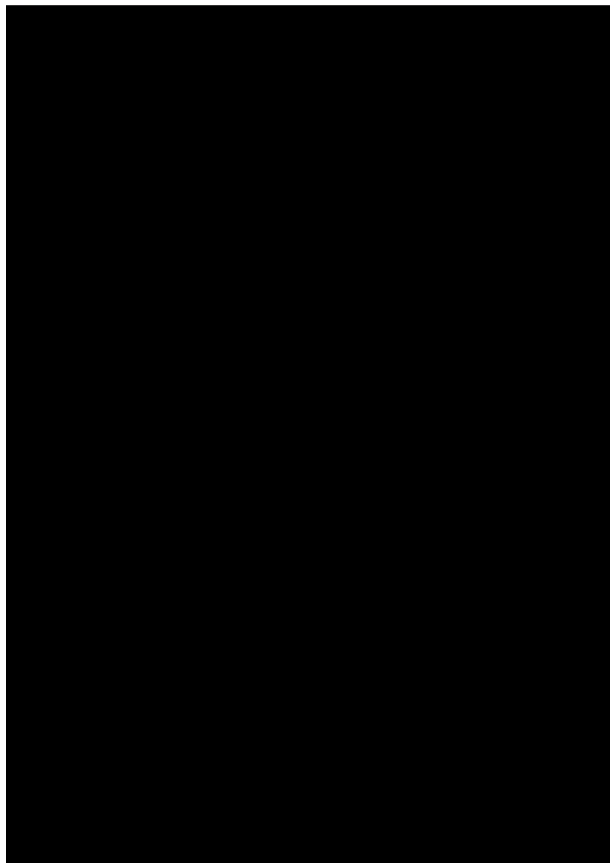
Software for controlling the network analyzer: PXle/Streamline Vector Network Analyzer Firmware

Measurement Basic Information

► Measurement Basic Information

- Test Setup graph >>

Please refer to below.



Measurement Basic Information

► Measurement Basic Information

- Description of How to Conduct Measurement :

Measurement Procedure

Measurement Setup:

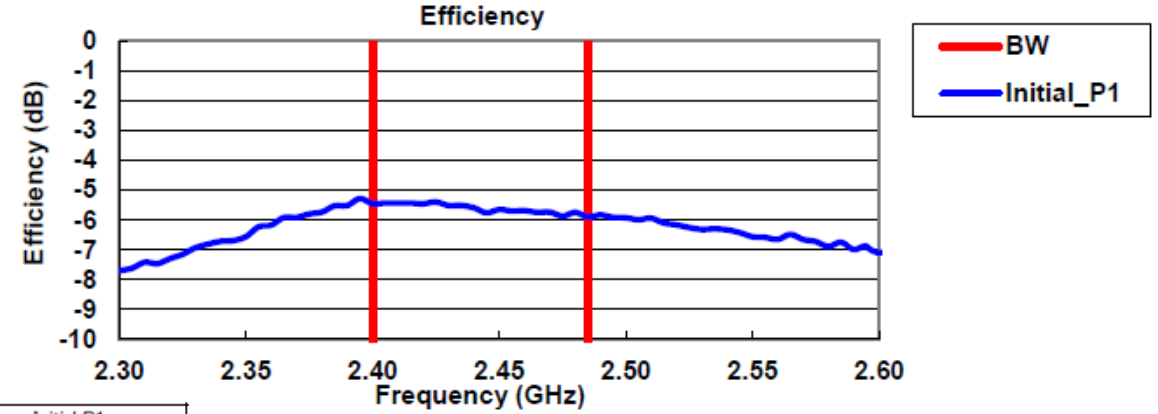
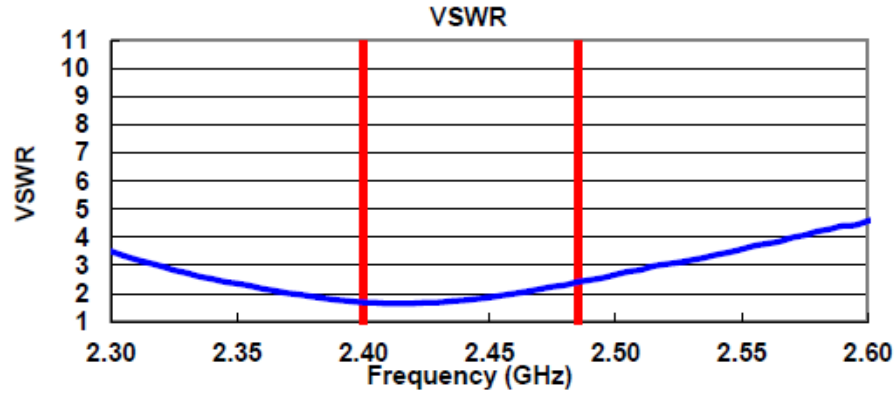
1. Open the DUT housing and expose the PCB.
2. Solder coaxial cables to Port1 and Port2.
3. Connect the cables to the VNA and perform calibration.
4. Measure the initial antenna matching performance.

- Calibration Equipment List :

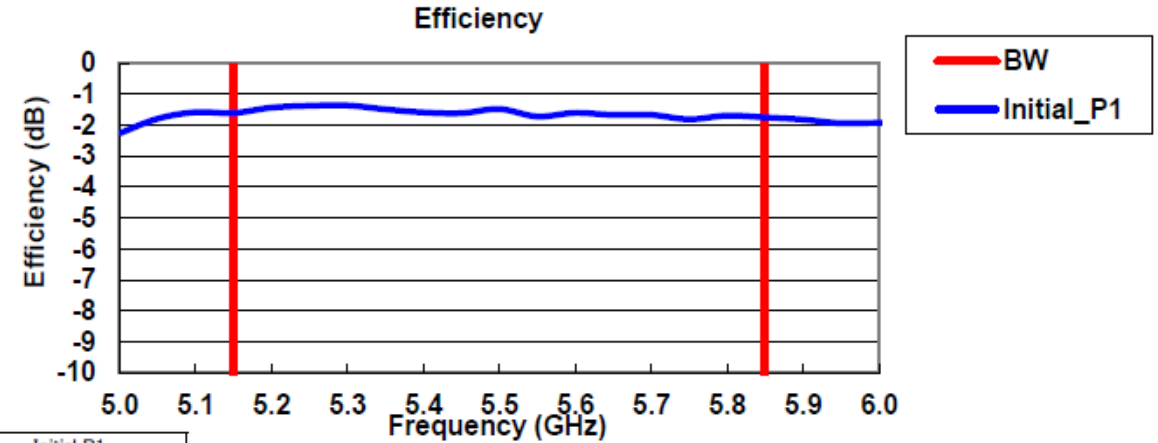
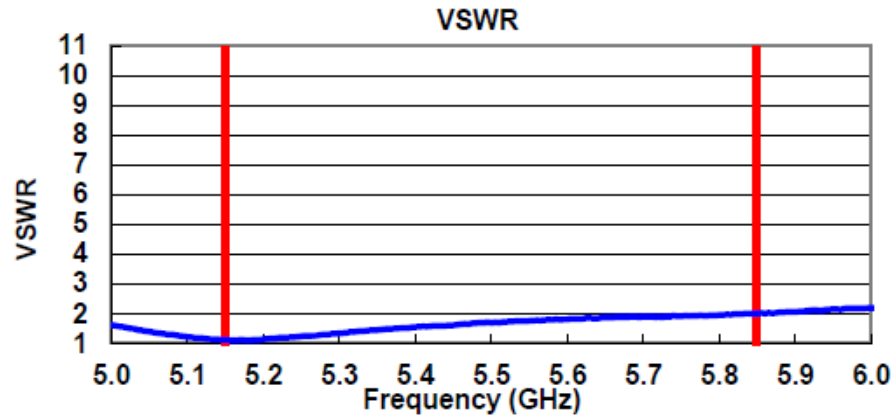
Description	Model No.	Serial No.	Calibrated Date	Calibrated Until
Chamber	StarLab PRO	TYO0572S	2025/9	2026/9
Network Analyzer	P5027A	MY58100206	2025/12	2026/12

Measurement Results

► VSWR & Efficiency



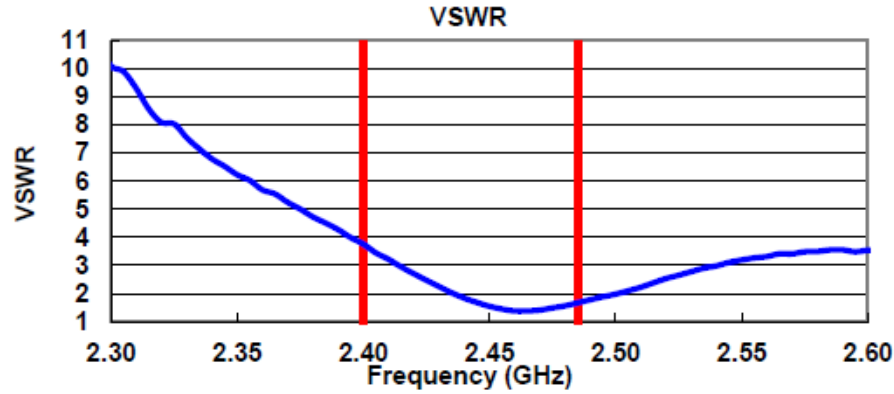
	Initial_P1		
Frequency[GHz]	2.4	2.442	2.485
VSWR	1.68	1.76	2.41
Efficiency[dB]	-5.45	-5.59	-5.90



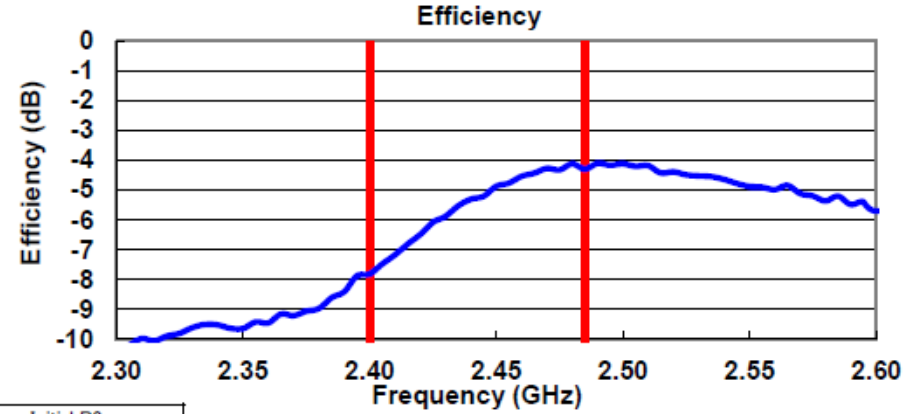
	Initial_P1		
Frequency[GHz]	5.15	5.5	5.85
VSWR	1.12	1.69	2.00
Efficiency[dB]	-1.60	-1.47	-1.74

Measurement Results

► VSWR & Efficiency

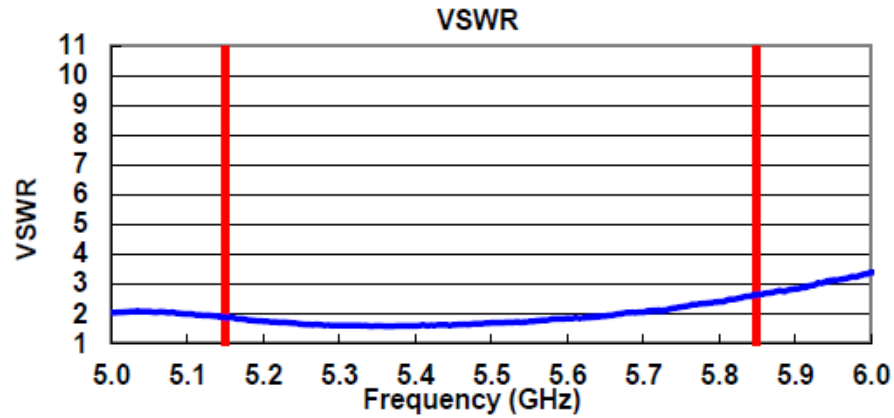


— BW
— Initial_P2

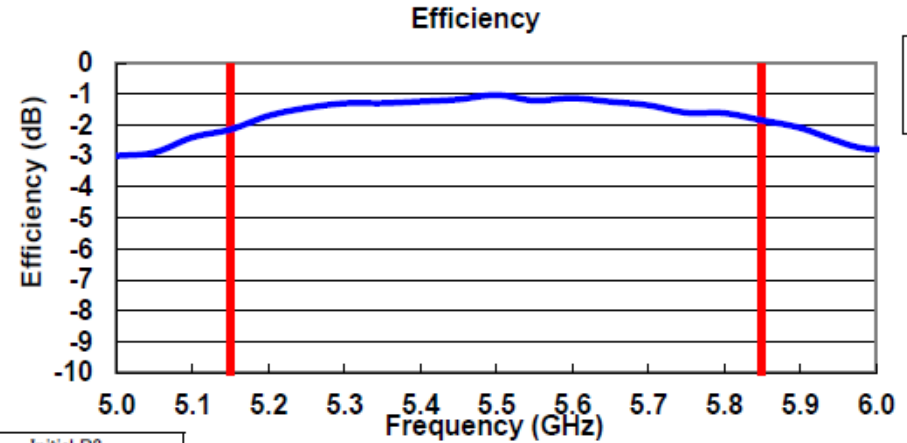


— BW
— Initial_P2

	Initial_P2		
Frequency[GHz]	2.4	2.442	2.485
VSWR	3.76	1.84	1.67
Efficiency[dB]	-7.81	-5.30	-4.29



— BW
— Initial_P2

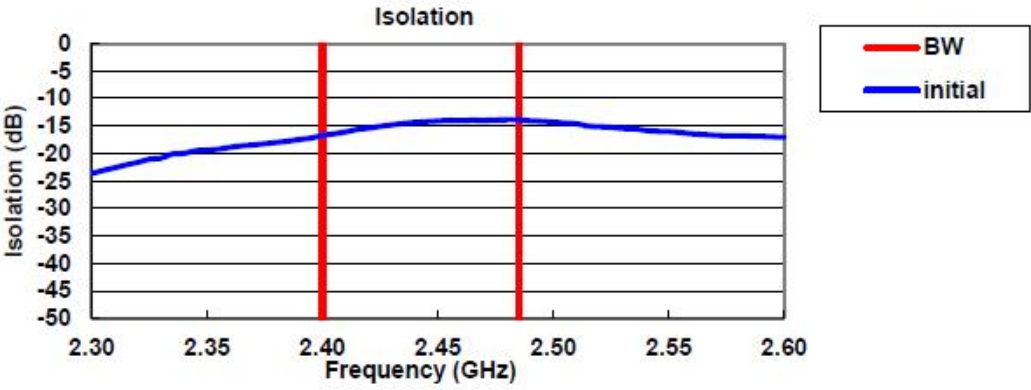


— BW
— Initial_P2

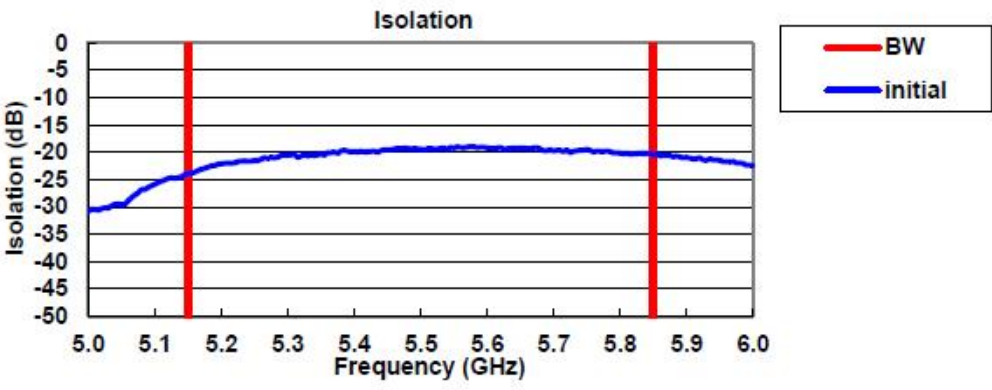
	Initial_P2		
Frequency[GHz]	5.15	5.5	5.85
VSWR	1.87	1.69	2.64
Efficiency[dB]	-2.13	-1.02	-1.84

Measurement Results

Isolation



	initial		
Frequency[GHz]	2.4	2.442	2.485
Isolation[dB]	-16.74	-14.36	-13.88



	initial		
Frequency[GHz]	5.15	5.5	5.85
Isolation[dB]	-23.88	-19.40	-20.49



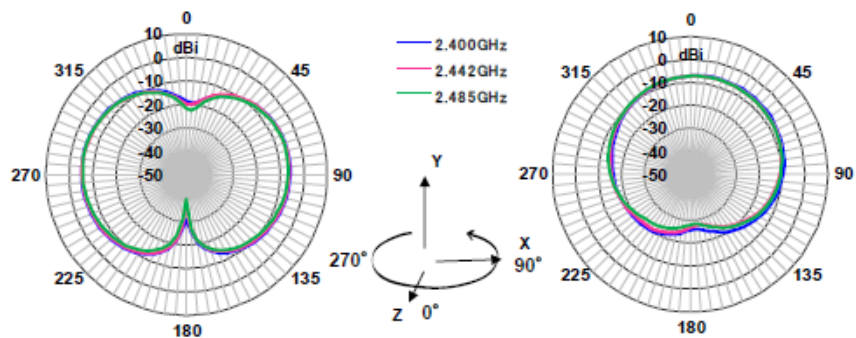
Radiation Pattern

Radiation Pattern (2.4GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE



Horizontal Polarization

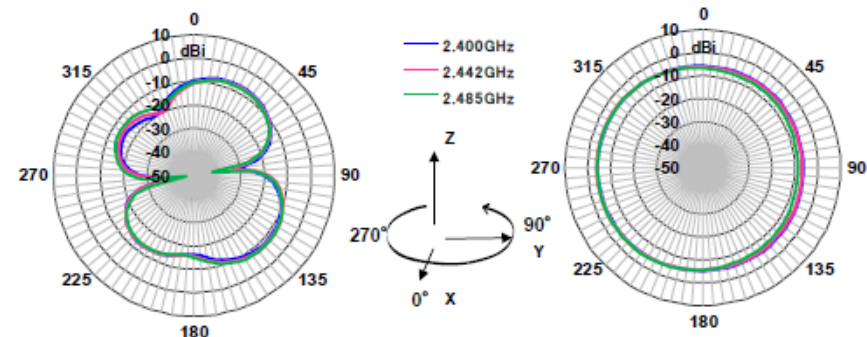
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-8.3	-8.7	-9.0
Maximum[dBi]	-5.1	-5.5	-5.5
Minimum[dBi]	-31.0	-37.9	-39.5

Vertical Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-10.79	-11.27	-11.21
Maximum[dBi]	-6.39	-6.93	-7.03
Minimum[dBi]	-25.96	-27.77	-28.01

initial_P1

X-Y PLANE



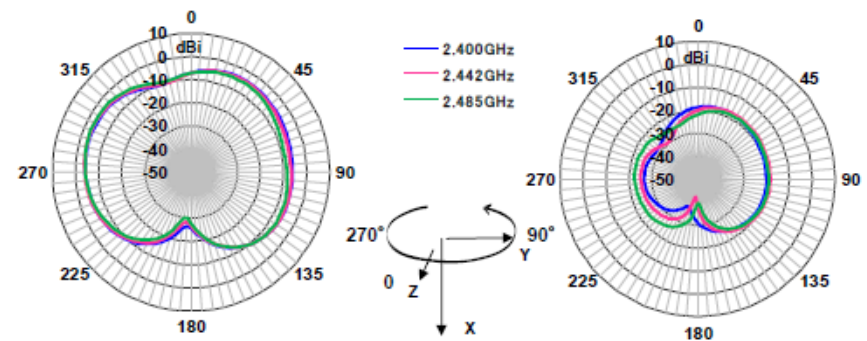
Horizontal Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-12.0	-12.0	-11.8
Maximum[dBi]	-7.1	-7.4	-7.3
Minimum[dBi]	-35.6	-38.5	-46.7

Vertical Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-5.2	-5.3	-5.8
Maximum[dBi]	-4.3	-4.0	-4.0
Minimum[dBi]	-6.3	-6.8	-8.6

Y-Z PLANE



Horizontal Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-6.6	-6.7	-7.1
Maximum[dBi]	-3.8	-3.3	-3.0
Minimum[dBi]	-26.6	-28.5	-30.1

Vertical Polarization

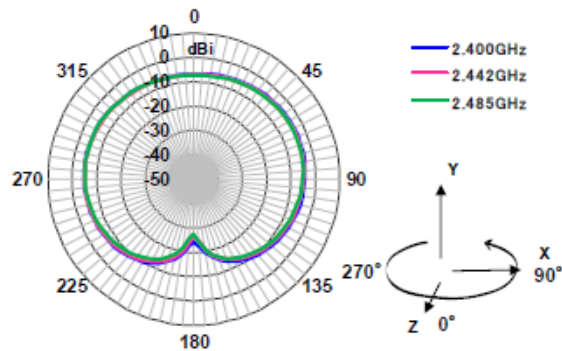
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-22.2	-21.5	-21.7
Maximum[dBi]	-17.8	-17.5	-18.3
Minimum[dBi]	-37.4	-42.4	-39.5

Total Power (2.4GHz Band)

PRODUCT ORIENTATIONS



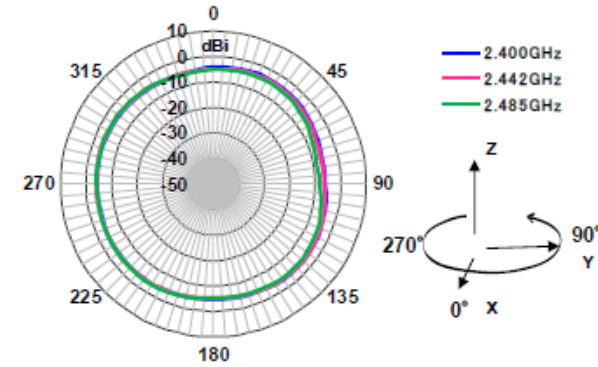
X-Z PLANE



Total Power			
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-6.3	-6.8	-7.0
Maximum[dBi]	-3.7	-4.2	-4.5
Minimum[dBi]	-24.5	-26.4	-27.4

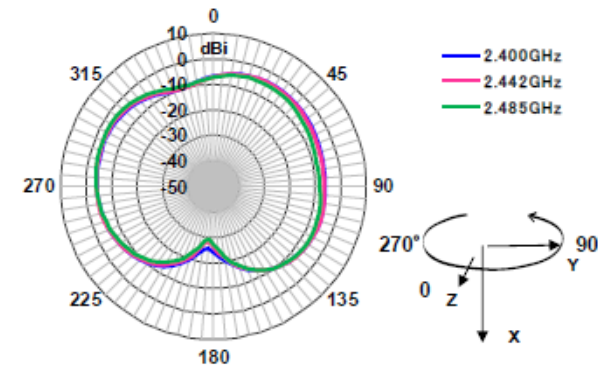
initial_P1

X-Y PLANE



Total Power			
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-4.4	-4.4	-4.8
Maximum[dBi]	-3.4	-3.6	-3.6
Minimum[dBi]	-6.2	-6.8	-8.6

Y-Z PLANE



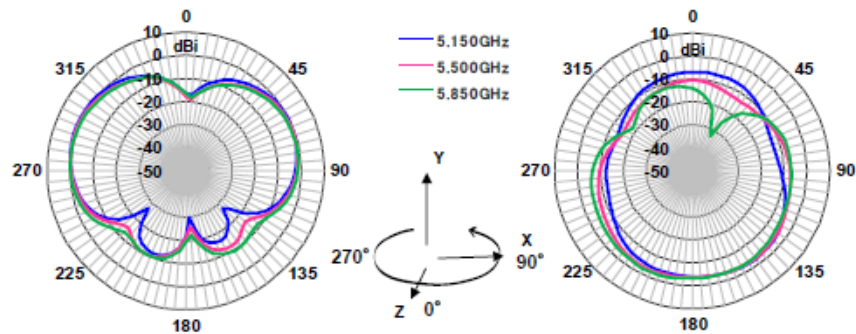
Total Power			
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-6.5	-6.5	-6.9
Maximum[dBi]	-3.8	-3.3	-2.9
Minimum[dBi]	-25.7	-28.3	-29.0

Radiation Pattern (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE



Horizontal Polarization

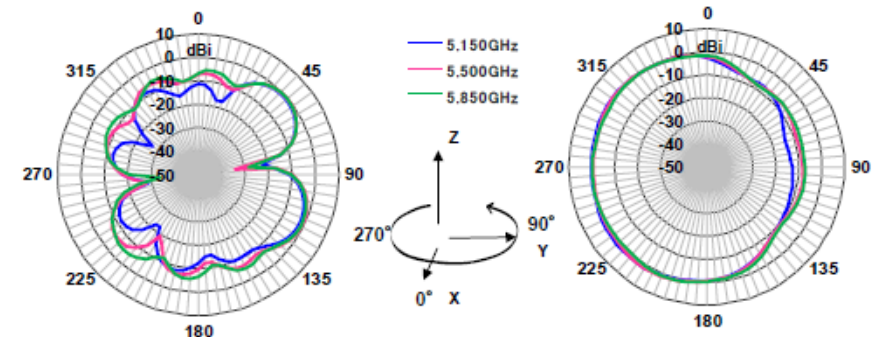
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-4.2	-4.4	-4.4
Maximum[dBi]	1.1	0.6	0.2
Minimum[dBi]	-29.9	-25.7	-22.3

Vertical Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-6.89	-6.67	-6.33
Maximum[dBi]	-2.51	-2.97	-2.33
Minimum[dBi]	-14.00	-15.56	-33.21

initial_P1

X-Y PLANE



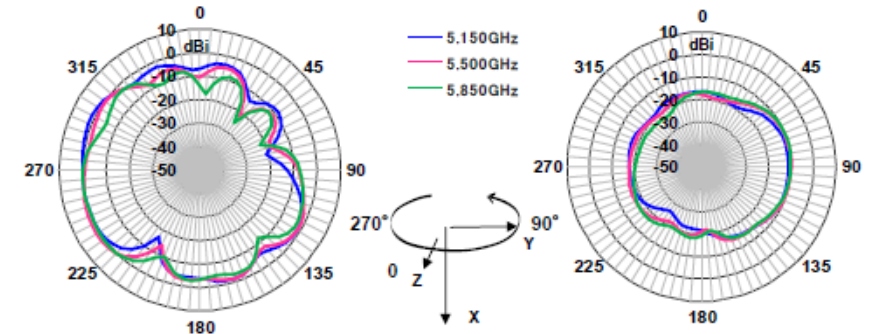
Horizontal Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-7.7	-6.2	-5.7
Maximum[dBi]	-0.6	0.2	0.1
Minimum[dBi]	-28.5	-34.0	-33.7

Vertical Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-1.8	-1.9	-1.9
Maximum[dBi]	1.7	1.6	1.3
Minimum[dBi]	-14.0	-9.3	-8.9

Y-Z PLANE



Horizontal Polarization

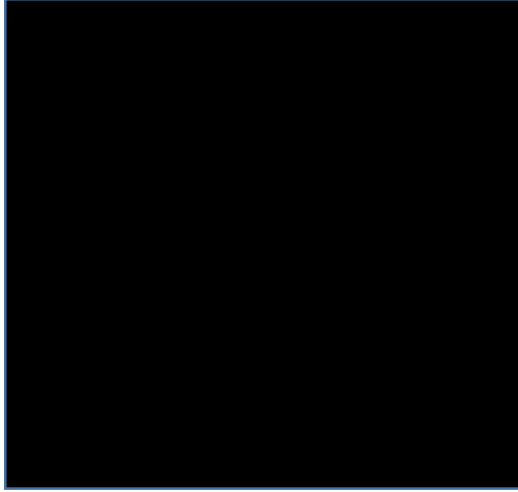
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-3.0	-3.2	-4.2
Maximum[dBi]	1.6	1.7	0.6
Minimum[dBi]	-20.9	-21.7	-25.3

Vertical Polarization

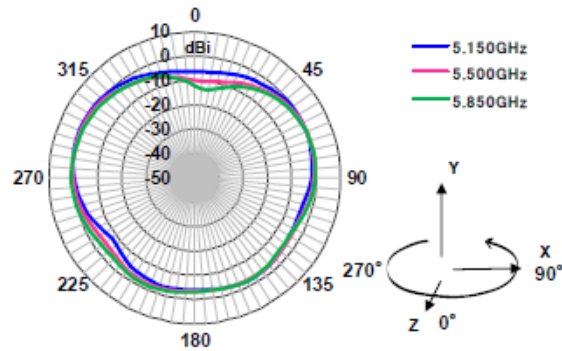
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-15.4	-14.6	-14.8
Maximum[dBi]	-11.0	-9.8	-9.7
Minimum[dBi]	-25.6	-21.8	-22.9

Total Power (5GHz Band)

PRODUCT ORIENTATIONS



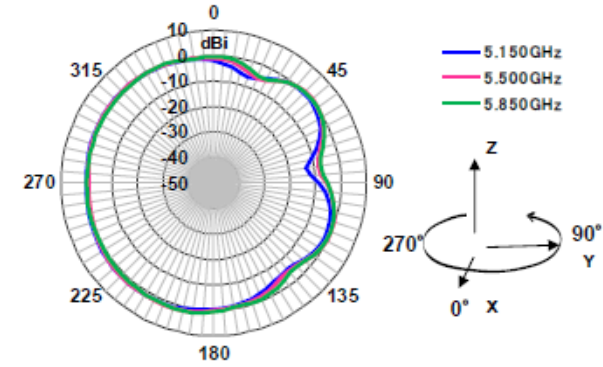
X-Z PLANE



Total Power			
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-2.3	-2.4	-2.2
Maximum[dBi]	1.3	0.7	0.8
Minimum[dBi]	-7.8	-10.0	-13.5

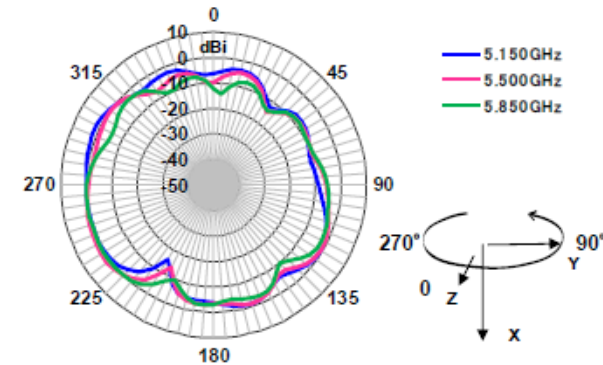
initial_P1

X-Y PLANE



Total Power			
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-0.8	-0.5	-0.4
Maximum[dBi]	1.7	1.7	1.8
Minimum[dBi]	-13.1	-8.6	-7.5

Y-Z PLANE



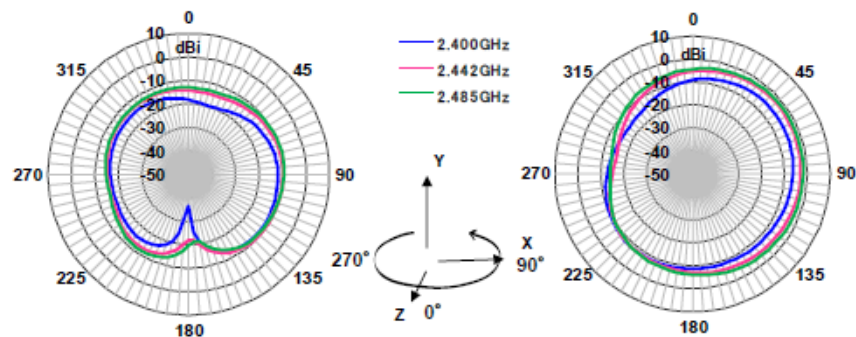
Total Power			
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-2.7	-2.9	-3.8
Maximum[dBi]	1.6	1.8	0.7
Minimum[dBi]	-15.9	-14.6	-14.3

Radiation Pattern (2.4GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE



Horizontal Polarization

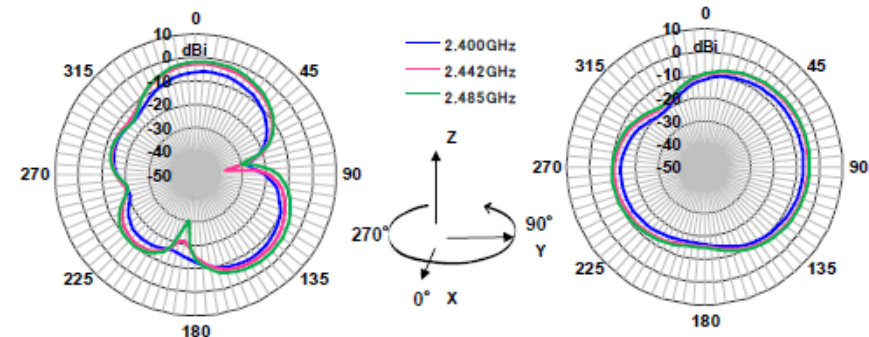
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-14.9	-12.8	-12.2
Maximum[dBi]	-11.3	-9.8	-9.3
Minimum[dBi]	-36.7	-21.9	-21.3

Vertical Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-8.43	-5.69	-4.65
Maximum[dBi]	-5.49	-2.22	-1.43
Minimum[dBi]	-15.75	-15.92	-14.25

initial_P2

X-Y PLANE



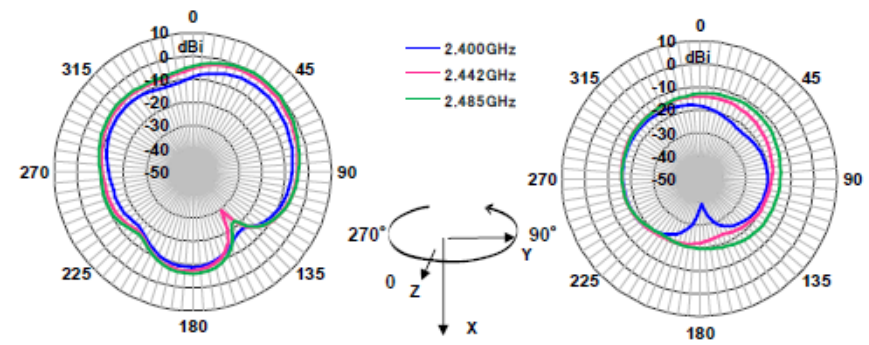
Horizontal Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-10.8	-8.3	-7.1
Maximum[dBi]	-5.9	-2.6	-1.6
Minimum[dBi]	-27.4	-37.1	-30.3

Vertical Polarization

	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-10.8	-8.6	-8.0
Maximum[dBi]	-6.9	-4.6	-4.1
Minimum[dBi]	-20.4	-18.2	-17.6

Y-Z PLANE



Horizontal Polarization

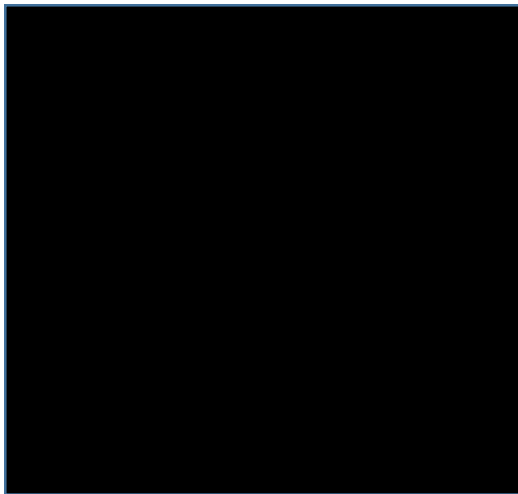
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-8.8	-6.3	-5.3
Maximum[dBi]	-4.1	-1.2	0.1
Minimum[dBi]	-17.2	-29.2	-22.1

Vertical Polarization

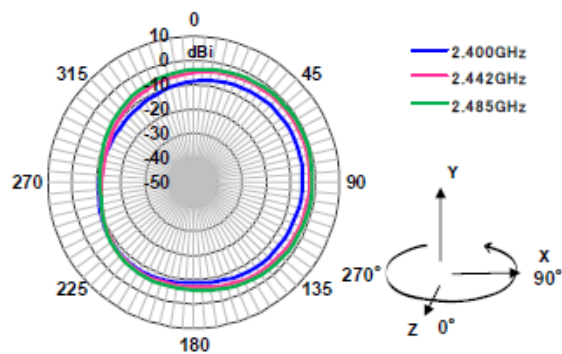
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-19.3	-16.7	-15.1
Maximum[dBi]	-15.8	-14.0	-11.9
Minimum[dBi]	-39.2	-23.7	-20.7

Total Power (2.4GHz Band)

PRODUCT ORIENTATIONS



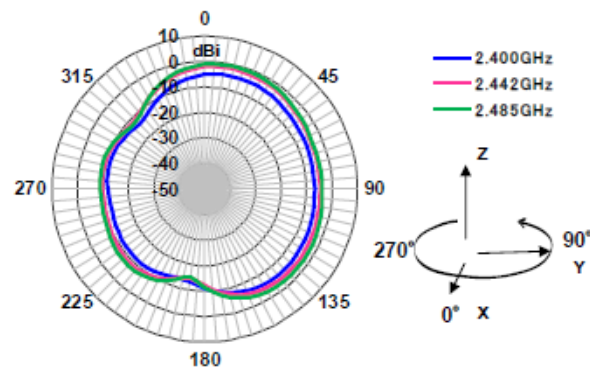
X-Z PLANE



Total Power			
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-7.5	-4.9	-4.0
Maximum[dBi]	-4.8	-1.7	-0.8
Minimum[dBi]	-12.4	-12.3	-11.5

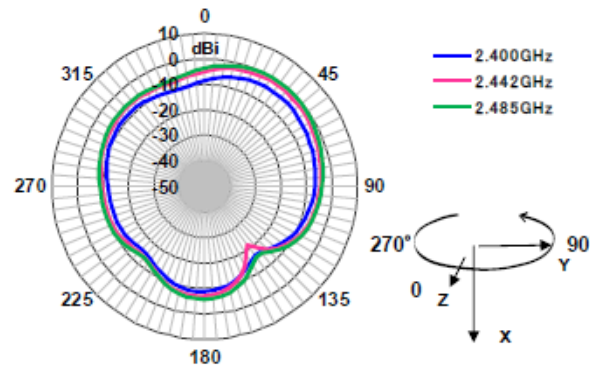
initial_P2

X-Y PLANE



Total Power			
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-7.8	-5.4	-4.6
Maximum[dBi]	-4.4	-1.5	-0.6
Minimum[dBi]	-13.7	-14.6	-14.9

Y-Z PLANE



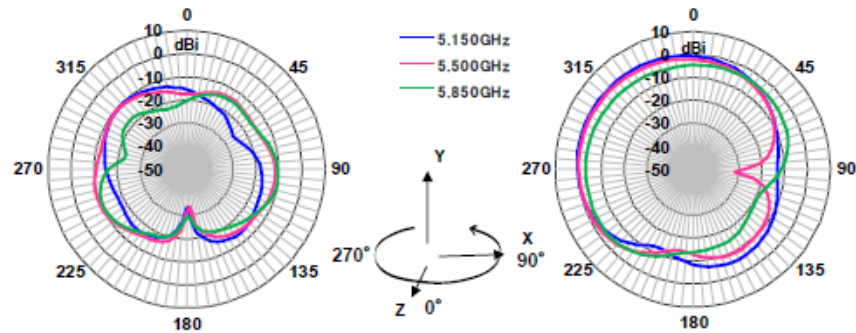
Total Power			
	2.400GHz	2.442GHz	2.485GHz
Average[dBi]	-8.5	-5.9	-4.8
Maximum[dBi]	-4.0	-1.0	0.4
Minimum[dBi]	-16.5	-21.6	-15.8

Radiation Pattern (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE



Horizontal Polarization

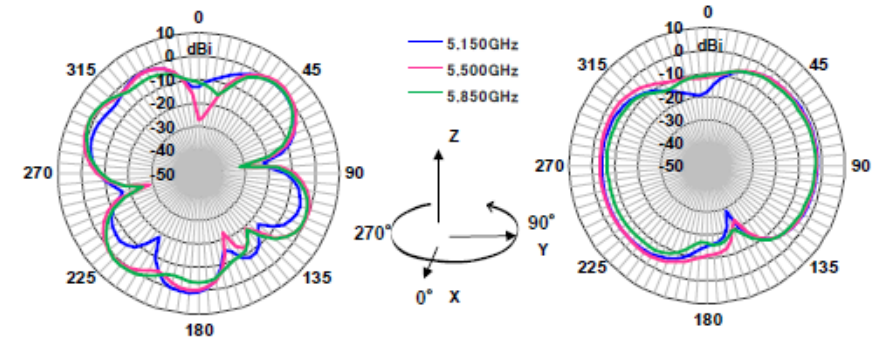
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-15.5	-13.2	-15.2
Maximum[dBi]	-10.6	-9.3	-10.3
Minimum[dBi]	-33.2	-33.8	-29.4

Vertical Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-2.88	-3.78	-5.77
Maximum[dBi]	1.06	0.15	-2.99
Minimum[dBi]	-13.09	-31.82	-19.31

initial_P2

X-Y PLANE



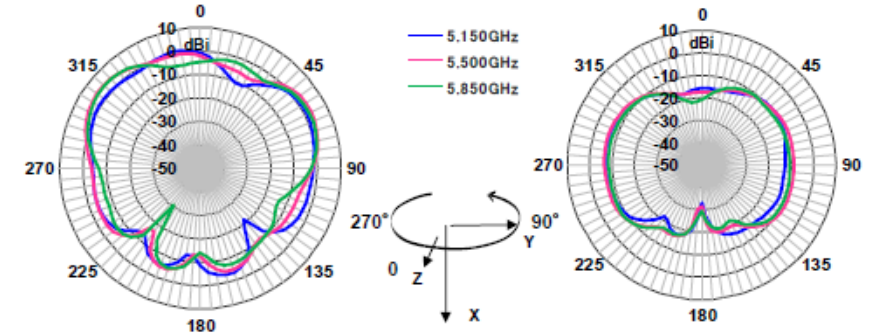
Horizontal Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-4.3	-2.7	-3.3
Maximum[dBi]	1.1	1.6	1.7
Minimum[dBi]	-21.8	-31.5	-32.1

Vertical Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-5.1	-4.7	-6.4
Maximum[dBi]	-1.7	-2.1	-2.4
Minimum[dBi]	-28.7	-23.4	-20.0

Y-Z PLANE



Horizontal Polarization

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-2.6	-1.3	-2.2
Maximum[dBi]	1.1	4.4	4.0
Minimum[dBi]	-21.1	-16.8	-30.8

Vertical Polarization

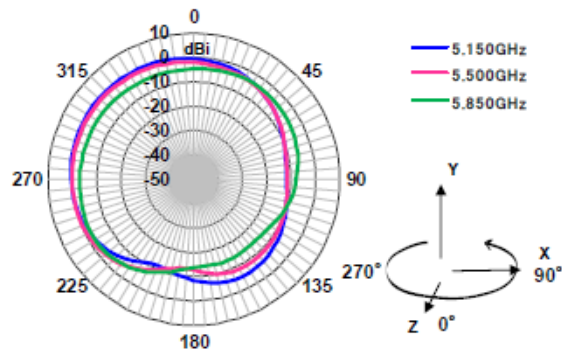
	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-11.5	-10.2	-11.5
Maximum[dBi]	-6.9	-6.2	-8.2
Minimum[dBi]	-33.2	-31.2	-29.4

Total Power (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE

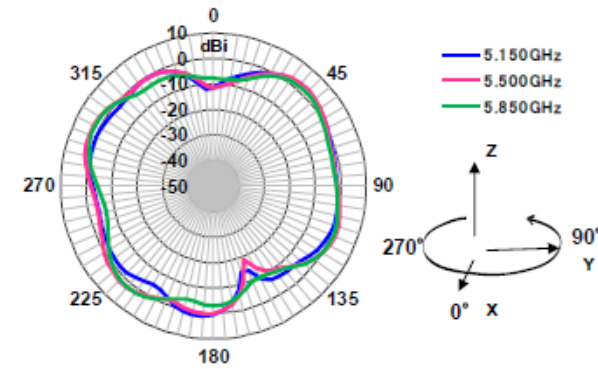


Total Power

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-2.7	-3.3	-5.3
Maximum[dBi]	1.3	0.5	-2.3
Minimum[dBi]	-11.8	-13.2	-14.3

initial_P2

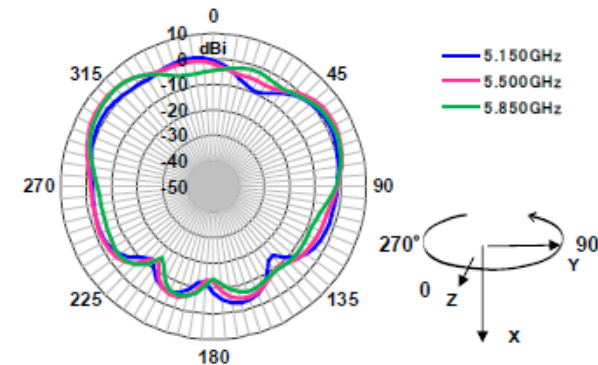
X-Y PLANE



Total Power

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-1.7	-0.6	-1.6
Maximum[dBi]	2.1	2.9	2.3
Minimum[dBi]	-14.5	-18.6	-9.8

Y-Z PLANE



Total Power

	5.150GHz	5.500GHz	5.850GHz
Average[dBi]	-2.1	-0.8	-1.8
Maximum[dBi]	1.4	4.6	4.2
Minimum[dBi]	-14.4	-13.2	-15.5

Summary of worst case gain

Antenna port	Frequency range	Worst case gain	Worst case test condition
Port 1	2.400GHz ~ 2.485GHz	-2.9 dBi	Y-Z Plane, 2.485GHz
Port 1	5.150GHz ~ 5.850GHz	1.8 dBi	Y-Z Plane, 5.500GHz
Port 2	2.400GHz ~ 2.485GHz	0.4 dBi	Y-Z Plane, 2.485GHz
Port 2	5.150GHz ~ 5.850GHz	4.6 dBi	Y-Z Plane, 5.500GHz

